

WHAT IS CLAIMED IS:

1. A solder preform comprising:

a) a solder matrix;

b) microparticles secured with the solder matrix; and

5 c) the microparticles being constructed so as to be capable of arranging during a solder bonding process so as to provide a substantially uniform separation between opposing soldered surfaces.

10 2. The solder preform of Claim 1 wherein the microparticles are embedded within the solder matrix.

3. The solder preform of Claim 2 wherein the microparticles are shaped so as to inhibit stacking while self arranging during a solder bonding process.

15 4. The solder preform of Claim 2 comprising an amount of microparticles with respect to an amount of the solder matrix so as to inhibit stacking of the microparticles during a solder bonding process.

20 5. The solder preform of Claim 4 wherein the microparticles are shaped so as to inhibit stacking while self arranging during a solder bonding process.

6. The solder preform of Claim 5 wherein the microparticles comprise microspheres.

25 7. The solder preform of Claim 6 wherein the microparticles comprise at least one of: (a) glass; (b) plastic; (c) elastomer; (d) metal; (e) semiconductor; (f) material capable of conducting

electric current; or (g) dielectric material.

8. The solder preform of Claim 2 wherein the microparticles comprise at least one of: (a) glass; (b) plastic; (c) elastomer; (d) metal; (e) semiconductor; (f) material capable of conducting electric current; or (g) dielectric material.

9. The solder preform of Claim 8 wherein the microparticles comprise generally regular particles.

10. The solder preform of Claim 9 wherein the microparticles comprise microspheres.

11. The solder preform of Claim 2 wherein the microparticles comprise as at least one of: (a) spheres, (b) polyhedrons; (c) crystalline particles, (d) powders, or (e) nanostructures.

12. The solder preform of Claim 2 wherein the microparticles have a coefficient of expansion such that a combined coefficient of expansion of the microparticles and the solder matrix is in a range between the opposing soldered surfaces.

13. The solder preform of Claim 2 wherein the microparticles have a coefficient of expansion lower than a coefficient of expansion of the solder matrix.

14. The solder preform of Claim 2 wherein the microparticles have a coefficient of expansion higher than a coefficient of expansion of the solder matrix.

15. The solder preform of Claim 2 wherein the microparticles have a coefficient of expansion substantially the same as a coefficient of expansion of the solder matrix.

5 16. The solder preform of Claim 2 wherein the microparticles are distributed substantially uniformly through the solder matrix.

17. The solder preform of Claim 2 wherein the microparticles are embedded near an exterior surface of the solder matrix.

10 18. The solder preform of Claim 1 wherein the microparticles are secured to an exterior surface of the solder matrix.

19. A solder preform comprising:

a) a solder matrix; and

15 b) a plurality of microspheres having a substantially similar diameter embedded within the solder matrix.

20. The solder preform of Claim 19 wherein the plurality of microspheres comprises microspheres comprising at least one of:

(a) glass; (b) plastic; (c) elastomer; (d) metal; (e) semiconductor; (f) material capable of conducting electric current; or (g) dielectric material.

25 21. The solder preform of Claim 20 wherein the plurality of microspheres has a coefficient of expansion such that a combined coefficient of expansion of the plurality of microspheres and the solder matrix is in a range between the coefficients of expansion of the opposing soldered surfaces.

22. A method for fabricating microparticle loaded solder preform, the method comprising:

a) selecting microparticles capable of self arranging within a solder alloy to provide a uniform separation between opposing solder surfaces during a solder bonding process;

b) combining the microparticles with the solder alloy; and

c) forming a solder preform comprising a solder matrix having the microparticles embedded therein.

23. The method of Claim 22 further comprising mixing the microparticles and solder alloy by at least one of: (a) shaking; (b) folding; (c) stirring; (d) pressing; or (e) rolling.

24. The method of Claim 23 further comprising heating the solder alloy prior to combining the microparticles.

25. The method of Claim 24 comprising cooling and portioning the solder matrix.

26. The method of Claim 25 wherein cooling comprises splat cooling the combined solder alloy and microparticles.

27. The method of Claim 22 wherein selecting microparticles comprises selecting microparticles being shaped so as to be inhibited from stacking while self arranging within the solder alloy between opposing solder surfaces during a solder bonding process.

28. The method of Claim 22 wherein combining comprises selecting an amount of microparticles with respect to an amount

of the solder alloy so as to inhibit stacking of the microparticles during a solder bonding process.

29. The method of Claim 22 wherein selecting comprises selecting microparticles comprised of at least one of: (a) glass;
5 (b) plastic; (c) elastomer; (d) metal; (e) semiconductor; (f) material capable of conducting electric current; or (g) dielectric material.

30. The method of Claim 22 wherein combining comprises combining one of: (a) microspheres; (b) powder; (c) polyhedral
10 particles; (d) crystalline particles; or (e) nanostructures.

31. The method of Claim 22 wherein selecting and combining comprises tailoring a coefficient of expansion of the solder preform such that a combined coefficient of expansion of the microparticles and the solder matrix is in a range between
15 coefficients of expansion of the opposing soldered surfaces.

32. The method of Claim 22 wherein selecting further comprises selecting microparticles so as to provide the solder matrix with a coefficient of expansion different than a coefficient of expansion of the solder alloy.

20 33. The method of Claim 22 wherein selecting comprises selecting microparticles having a coefficient of expansion substantially the same as a coefficient of expansion of the solder matrix.

25 34. A method for fabricating microparticle solder preform, the method comprising:

a) heating a solder alloy;

b) combining microparticles with the solder alloy; and
c) forming a solder preform comprising a solder matrix having embedded microparticles.

5 35. The method of Claim 34 wherein combining comprises at least one of: (a) shaking the combined solder alloy and the microparticles; (b) stirring the combined solder alloy and the microparticles (c) folding the microparticles into the solder alloy; or (d) pressing the microparticles into the solder alloy.

10 36. The method of Claim 35 further comprising cooling the solder alloy while mixing the solder alloy and the microparticles.

37. The method of Claim 35 wherein forming the solder preform comprises splat cooling the solder alloy and microparticles.

15 38. The method of Claim 34 wherein combining comprises selecting an amount of microparticles with respect to an amount of the solder alloy so as to inhibit stacking of the microparticles during a solder bonding process.

20 39. The method of Claim 34 wherein combining microparticles comprises combining microparticles shaped so as to inhibit stacking while self arranging during a solder bonding process.

40. The method of Claim 39 wherein combining microparticles comprises combining microspheres.

25 41. The method of Claim 34 wherein combining microparticles comprises combining generally regular particles.

42. The method of Claim 34 further comprising tailoring a coefficient of the solder preform such that a combined coefficient of expansion of the microparticles and the solder matrix is in a range between coefficients of expansion of surfaces to be soldered.

43. The method of Claim 34 wherein combining further comprises selecting microparticles so as to provide the solder matrix with a coefficient of expansion different than a coefficient of expansion of the solder alloy.

44. The method of Claim 34 wherein combining comprises combining microparticles having a coefficient of expansion substantially the same as a coefficient of expansion of the solder matrix.